

CLAIMS

1. A process for the conversion of heavy feedstocks selected from heavy crude oils, distillation residues, heavy oils coming from catalytic treatment, thermal tars, bitumens from oil sands, various kinds of coals and other high-boiling feedstocks of a hydrocarbon origin known as black oils, by the combined use of the following three process units: hydroconversion with catalysts in slurry phase (HT), distillation or flash (D), deasphalting (SDA), comprising the following steps:
- mixing at least part of the heavy feedstock and/or at least most of the stream containing asphaltenes obtained in the deasphalting unit with a suitable hydrogenation catalyst and sending the mixture obtained to a hydrotreatment reactor (HT) into which hydrogen or a mixture of hydrogen and H_2S is charged;
 - sending the stream containing the hydrotreatment reaction product and the catalyst in dispersed phase to one or more distillation or flash steps (D) whereby the different fractions coming from the hydrotreatment reaction are separated;
 - recycling at least part of the distillation residue (tar) or liquid leaving the flash unit, contain-

- ing the catalyst in dispersed phase, rich in metal sulfides produced by demetallation of the feedstock and possibly coke, to the deasphalting zone (SDA) in the presence of solvents, optionally also fed with
5 at least a fraction of the heavy feedstock, obtaining two streams, one consisting of deasphalted oil (DAO) and the other containing asphaltenes, characterized in that the stream containing the hydrotreatment reaction product and the catalyst in
10 dispersed phase, before being sent to one or more distillation or flash steps, is subjected to a high pressure separation pre-step in order to obtain a light fraction and a heavy fraction, the heavy fraction alone being sent to said distillation step(s)
15 (D).
2. The process according to claim 1, wherein the light fraction obtained by means of the high pressure separation step is sent to a secondary hydrogenation post-treatment section, producing a lighter fraction
20 containing C₁-C₄ gas and H₂S and a heavier fraction containing hydrotreated naphtha and gas oil.
3. The process according to claim 2, wherein the hydrogenation post-treatment reaction is effected at a pressure ranging from 7 to 14 MPa.
- 25 4. The process according to at least one of the claims

from 1 to 3, wherein all the heavy feedstock is mixed with a suitable hydrogenation catalyst and sent to the hydrotreatment reactor (HT), whereas at least 60% of the stream containing asphaltenes, which also contains catalyst in dispersed phase and possibly coke and is enriched with metals coming from the initial feedstock, is recycled to the hydrotreatment zone.

5. The process according to claim 4, wherein at least 80% of the stream containing asphaltenes is recycled to the hydrotreatment zone.
6. The process according to at least one of the claims from 1 to 3, wherein part of the heavy feedstock and at least most of the stream containing asphaltenes, which also contains catalyst in dispersed phase and possibly coke, are mixed with a suitable hydrogenation catalyst and sent to the hydrotreatment reactor, whereas the remaining part of the heavy feedstock is sent to the deasphalting section.
7. The process according to at least one of the claims from 1 to 3, wherein at least most of the stream containing asphaltenes, which essentially consists of said asphaltenes, is mixed with a suitable hydrogenation catalyst and sent to the hydrotreatment reactor, whereas all the heavy feedstock is fed to the

deasphalting section.

8. The process according to claim 1, wherein part of the distillation residue (tar) or liquid leaving the flash unit is recycled to the deasphalting zone (SDA) and at least part of the remaining part of said distillation or flash residue is sent to the hydrotreatment reactor.
9. The process according to claim 8, wherein at least part of the distillation or flash residue is sent to the hydrotreatment reactor together with at least part of the stream containing asphaltenes coming from the deasphalting section (SDA).
10. The process according to claim 1, wherein at least 80% by weight of the distillation residue is recycled to the deasphalting zone.
11. The process according to claim 10, wherein at least 95% by weight of the distillation residue is recycled to the deasphalting zone.
12. The process according to claim 1, wherein at least part of the remaining quantity of distillation residue (tar), not recycled to the deasphalting zone is recycled to the hydrotreatment section.
13. The process according to claim 1, wherein the distillation steps are carried out at a reduced pressure ranging from 0.0001 to 0.5 MPa.

14. The process according to claim 13, wherein the distillation steps are carried out at a reduced pressure ranging from 0.001 to 0.3 MPa.
- 5 15. The process according to claim 1, wherein the hydrotreatment step is carried out at a temperature ranging from 370 to 480°C and at a pressure ranging from 3 to 30 MPa.
- 10 16. The process according to claim 15, wherein the hydrotreatment step is carried out at a temperature ranging from 380 to 440°C and at a pressure ranging from 10 to 20 MPa.
- 15 17. The process according to claim 1, wherein the deasphalting step is carried out at temperature ranging from 40 to 200°C and at a pressure ranging from 0.1 to 7 MPa.
18. The process according to claim 1, wherein the deasphalting solvent is a light paraffin with from 3 to 7 carbon atoms.
- 20 19. The process according to claim 1, wherein the deasphalting step is carried out under subcritical or supercritical conditions with one or more steps.
20. The process according to claim 1, wherein the stream consisting of deasphalted oil (DAO) is fractionated by means of conventional distillation.
- 25 21. The process according to claim 1, wherein the stream

consisting of deasphalted oil (DAO) is mixed with the products separated in the distillation step after being condensed.

22. The process according to claim 1, wherein the hydrogenation catalyst is a decomposable precursor or a preformed compound based on one or more transition metals.
23. The process according to claim 22, wherein the transition metal is molybdenum.
24. The process according to claim 1, wherein the concentration of the catalyst in the hydroconversion reactor, defined on the basis of the concentration of the metal or metals present, ranges from 300 to 20000 ppm.
25. The process according to claim 24, wherein the concentration of the catalyst in the hydroconversion reactor ranges from 1000 to 10000 ppm.
26. The process according to at least one of the claims from 1 to 3, wherein a fraction of the stream containing asphaltenes, coming from the deasphalting section (SDA), called flushing stream, is sent to a treatment section with a suitable solvent for the separation of the product into a solid fraction and a liquid fraction from which said solvent can be subsequently separated.

27. The process according to claim 26, wherein the flushing stream is in a quantity ranging from 0.5 to 10% by volume with respect to the fresh feedstock.
28. The process according to claim 26, wherein at least
5 part of the liquid fraction deriving from the treatment section of the flushing is sent as such or after being separated from the solvent and/or after the addition of a suitable fluxing liquid to the Fuel Oil fraction.
- 10 29. The process according to claim 28, wherein at least part of the liquid fraction deriving from the treatment section of the flushing is recycled to the hydrotreatment reactor (HT).
- 15 30. The process according to claim 26, wherein the solvent used in the treatment section of the flushing is an aromatic solvent or a mixture of gas oils produced in the process itself or available in refineries.
- 20 31. The process according to claim 30, wherein the aromatic solvent is toluene and/or xylene blends.
32. The process according to claim 26, wherein the volumetric ratio solvent/flushing stream varies from 1 to 10.
- 25 33. The process according to claim 32, wherein the volumetric ratio solvent/flushing stream varies from 1

to 5.

34. The process according to claim 33, wherein the volumetric ratio solvent/flushing stream varies from 1.5 to 3.5.
- 5 35. The process according to claim 26 and 22, wherein the solid fraction of the solid treated is sent to a further selective recovery treatment of the transition metal(s) contained in the hydrogenation catalyst.
- 10 36. The process according to claim 35, wherein the transition metal(s) recovered, is recycled to the hydrotreatment reactor (HT).

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